velocity of sound through the unignited gas, and is reflected from the ends of the tube. The flame is checked while these two compression-waves pass through the burning gases, and is then helped forward by the waves moving in the same direction. The movement then becomes unsymmetrical; the flame to the left is checked a second time before it reaches its end of the tube, that to the right reaches the end of the tube and sends back a strong retonation-wave. The wave from the right is of greater intensity and moves more rapidly than that started a little later from the left, and, although the reflections of these waves at first run nearly parallel, the stronger gradually overtakes the weaker and coalesces with it, and the single wave continues to traverse the tube from end to end. As many as one hundred reflections have been counted in an explosion of this kind. Fig. 3 shows in outline the movements of the flame and compression-waves.

The flame in its initial stage is only very feebly luminous, a fact which has led to erroneous beliefs in regard to the mechanism of explosion. Von Oettingen and von Gernet, failing to photograph the flame itself, introduced finely-divided salts into the tube, and obtained brilliant pictures of the explosion showing a series of parallel waves. They believed that the explosion itself was *quite invisible*, the movements shown in the pictures being compression-waves rushing through the burning gases after the explosion was completed. These parallel waves, following each other in close succession, were supposed to be due to "successive partial explosions" proceeding from the spark, in accordance with Bunsen's theory of discontinuous step-like combustion.

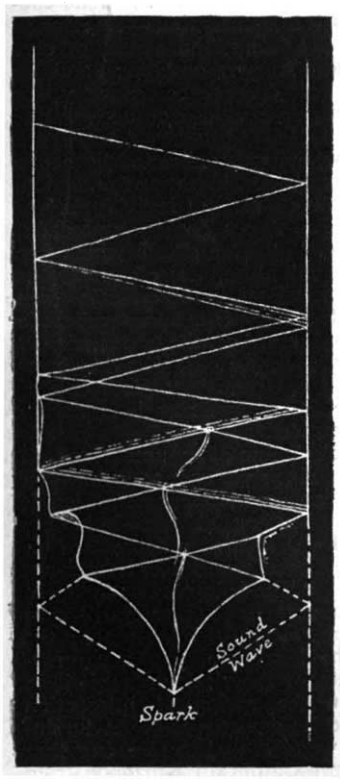

FIG. 3

The influence of water vapour on the combustion of hydrogen with oxygen has formed the subject of much recent research. Some years ago Dixon showed that an electric spark would fire ordinary electrolytic gas whether in the dried or moist condition, and that the velocity of detonation was practically unaffected by the presence of aqueous vapour. The experiments of Baker with very pure hydrogen and oxygen have, however, shown that the initiation of the flame is largely influenced by the purity of the mixture. It might be expected that the initial phase of the explosion (before detonation is set up) would be modified if the interaction of the gases depends on the presence of previously formed water molecules. Dixon and Bradshaw have shown by photographs that this is not the case; the flame, once it has been started by a spark, spreads with the same velocity in the dry as in the moist gases, and undergoes the same changes in intensity. So far as the development and movements of the flame are concerned, the presence of water-vapour appears to make no difference in the union of hydrogen and oxygen.

In a recent paper Dixon and Bradshaw have shown that the compression-wave which travels in front of the flame in the initial stage of the explosion may, under certain conditions, bring about the spontaneous inflammation of the gases in a region of the tube some distance from the spark. Fig. 4 shows the explosion of hydrogen and oxygen in a tube one end of which has been drawn off in the blowpipe flame in the manner of a Carius bomb-tube, so that the end has the form of a funnel followed by a short capillary. The explosion is started in the middle of the tube (*s*); almost simultaneously the gas inflames in the capillary (*c*). The flames meet midway between the fine dark vertical lines, which are reference marks produced by fastening narrow strips of black paper outside the explosion tube to eclipse the flame as it passes. The broad band is due to the clamp which held the tube in position. The firing of the gas in the capillary is caused by the sudden increase of pressure in the funnel, the heat of compression raising the gases to the temperature of ignition. The wave produced is analogous to the tidal "bore" in a funnel-shaped estuary. L. B.

FIG. 4.

THE SEVENTH INTERNATIONAL ZOOLOGICAL CONGRESS.

THE meeting of zoologists at Boston was formally convened on Monday, August 19, in the Jordan Hall. Prof. Alexander Agassiz, as president, welcomed the members and delegates, and gave a short but vivid address on the recent progress of oceanographical research, especially in its zoological aspects. He directed attention, for instance, to the extremely interesting facts which he has discovered in regard to the relations of the deep-sea faunas on the two sides of the Isthmus of Panama. In a country where the stranger cannot but be impressed with the amount of public and private money which seems to be placed at the disposal of scientific institutions, it was interesting to hear Prof. Agassiz's complaint that the Government had not taken any steps to publish an account of the treasures of the *Albatross* expedition. It was one of those touches of nature which make the whole world kin.

Vice-presidents were appointed, such as Mr. Bateson (England), Prof. Hubrecht (Holland), Prof. H. F. Osborn (United States), Dr. Watase (Japan); and, on the report of Prof. Blanchard, the Czar Nicolas prize was awarded to Prof. Cuénot, of Paris, for his research on hybrids. Special mention was also made of theses by M. Loisel, of Paris, and M. Standfuss, of Zürich, which did not arrive in

time to be considered in making the award. Prof. R. Hertwig, of Munich, gave a long address on the most recent researches on cytology. He spoke in German, and it was not always easy, in spite of his lucidity and illustrative charts, to follow his discussion of the intricate relations between the nucleoplasm and the cytoplasm. Of particular interest was the account of his observations on the influence of temperature on the size and rate of division of the chromosomes.

The meetings of the sections were held in the truly magnificent buildings of the Harvard Medical School, which stand like five marble temples on the three sides of a quadrangle, and are admirably designed for internal re-adjustment or for external extension outwards as future circumstances may demand. The internal equipment of the various departments, *e.g.* Prof. C. S. Minot's embryological laboratories, called forth universal admiration. Great praise is due to the organisers of the congress for the way in which they secured the orderly accomplishment of the scientific business and for the embarrassingly tempting arrangements for excursions. For creature comforts most thoughtful care was taken, from the providing of *al fresco* luncheons to the presence of a nurse!

The intellectual bill of fare—a metaphor which cannot be avoided amid so much hospitality—was all too full. Never can the zoologist of good appetite and digestion have wished more ardently that he could be, as Sir Boyle Roche's bird, "in two places at once." For in spite of clever arrangements, there was no avoiding the simultaneous occurrence of interesting events. This holds especially true in regard to the sectional addresses, which included the following:—The problem of the vertebrate head, by Prof. J. P. McMurrich; the chemical aspect of fertilisation, by Prof. Jacques Loeb; cytology and taxonomy, by Prof. C. E. McClung; facts limiting the theory of heredity, by Mr. William Bateson; fœtal membranes, by Prof. A. A. W. Hubrecht; operative factors in development, by Prof. W. Roux; economic entomology, by Dr. L. O. Howard; the relations between North American and European Hemiptera, by Dr. Geza Horvath; the problem of organic development, by Prof. C. O. Whitman; migrations of Tertiary faunas, by Prof. C. Depéret; the scope and promise of systematic zoology, by Dr. T. Gill; the evolution of continents as illustrated by the geographical distribution of animals, by Dr. R. F. Scharff.

One of the most striking of the sectional addresses delivered at the congress was that on the chemical character of fertilisation, by Prof. Jacques Loeb, of Chicago, delivered before an audience of about three hundred. He began by distinguishing between the function of the spermatozoon as a bearer of hereditary qualities and its function as an instigator of development. In connection with the latter the foremost effect is the enormous synthesis of nuclear matter. To attain to some understanding of the hydrolytic and other processes which the spermatozoon sets up in the egg, the most promising path at present is to study the phenomena of artificial parthenogenesis. By adding to "hypertonic" sea-water a small quantity of a monobasic fatty acid, Prof. Loeb has been able to induce in sea-urchin ova the formation of an egg membrane and perfectly normal development in the great majority of the eggs of a given female. The effects of the spermatozoon were thus more perfectly imitated than by the previous purely osmotic methods. Prof. Loeb's results lead him to the general conclusion that the membrane-formation is connected with the solution of a layer of fatty material underneath the surface-film of the egg. It seems that the essential feature of the process of fertilisation consists first in a liquefaction or hydrolysis, or both, of fatty compounds in the egg, and second, in starting the processes of oxidation in the right direction. The lecturer ended his discussion by making a very suggestive comparison between the chemical processes in the germination of oily seeds and those in the early development of the animal ovum. The general idea to which the experiments on the artificial parthenogenesis (of sea-urchins, Lottia, Polynöe, and Sipunculus) point is that the spermatozoon acts as a catalyser.

Sir John Murray gave a general afternoon address on the progress of oceanography, and another was given by that genial iconoclast, Prof. W. K. Brooks, who calmly asked, "Are Heredity and Variation facts?" If philosophy is a criticism of categories, the latter address was certainly philosophical; for its aim was to show that specialisation—none the less dangerous because often unconscious—necessarily leads to partial abstractions. Such, according to Prof. Brooks, are heredity and variation. The former means likeness between offspring and their parents; the latter means divergence of the offspring from the likeness of their parents. But these two aspects in isolation are not facts; they express our artificially abstracted realisation of *one* fact—kinship and individuality are inseparable. It might be suggested that heredity is more correctly definable as the relation of genetic continuity between successive generations—a relation which presents, on the one hand, the aspect of continuity, persistence, or hereditary resemblance, and, on the other, the aspect of divergence, novelty, or variation; but the lecturer would not accept this suggestion.

Much of the lecture, which was enlivened by a fine humour and by epigrams condensing much reflection, was in great part an apologia for the individuality of the living creature. "Like never does produce like, but only something like." "The sheep which the morphologist finds to be all alike, are all unlike, as the shepherd's dog knows. Each ewe knows its own lamb." (Is even this a fact?) "One never meets the average man, the normal man of the statistician." "Statistics of mortality are very useful, but they have no bearing on your death or mine." "We speak of *the* struggle for existence, but every struggle is private and particular in every respect."

If we follow Prof. Brooks's line of argument, we are led to the conclusion that since we cannot think of a living organism without an environment in which it lives, then the living organism is not a fact—it is only a scientific abstraction of one side of a fact; and so far as we understand, the Berkeleyan biologist did not hesitate to take this step. "The being is not in itself, but in its reciprocal relations." It is therefore illusory to speak of a material substratum of inheritance; the real creature is not in the idioplasm, or the chromosomes, or the determinants, or the vital units; it is to be sought and found in the reciprocal interaction between the organism and its environment. A luminous section of the lecture was devoted to showing that supposing one knew the pre-Cambrian Rhizopod from which all animals are descended, and knew it thoroughly, yet one would not be able to foresee from such knowledge all that was to follow. The history was not really in the pre-Cambrian ancestor, for living creatures, as they have evolved, have, so to speak, worked time into their being, and evolution is continual creation.

The last days of the formal meetings of the congress were overcrowded with remarkable communications, too numerous even to mention in a brief notice, but we cannot refrain from remarking on the addresses given

by Mr. Bateson, on facts limiting our theories of inheritance; by Prof. C. O. Whitman, on orthogenesis in pigeons and on the relations of ontogeny and phylogeny; by Dr. L. O. Howard, on the recent progress of economic zoology; and by Prof. H. F. Osborn, on evolution from a palæontologist's point of view—all of them very remarkable and memorable expositions.

At the formal close of the congress it was announced that the 1910 meeting would be held at Graz under the presidency of Prof. von Graff. A welcome announcement was made that the committee on nomenclature had at last arrived unanimously at a code of rules which would cover 90 per cent. of all possible difficulties. Dr. Stiles further said that the committee would continue to sit in judgment on the remaining 10 per cent. of intricate difficulties, and that they had resolved to prepare a check-list of some thousands of common animals the names of which were not henceforth to be changed on any pretext whatsoever. As Prof. Agassiz remarked, the only difficulty remaining was the cheque. Prof. Blanchard announced that a third prize had been offered by Russia for adjudication by the congress and by representatives of the Zoological Society of St. Petersburg. It was offered to perpetuate the memory of the great Russian zoologist, Alexander Kowalewsky. In a very neat speech Prof. Hubrecht, of Amsterdam, thanked the local committee, the organisers, and the president for their indefatigable labours in making the congress a conspicuous success, and Prof. Blanchard, of Paris, eloquently expressed the gratitude of the ladies for the hospitality which had been shown them by the ladies of Boston.

NOTES.

THE weather conditions for the three summer months, June to August, have proved very disappointing, and the principal characteristic has been the entire absence of warm days. At Greenwich there have only been forty days during the whole period with a temperature of 70° and above. This is precisely the same number as in the phenomenally wet summer of 1903, but it is very greatly below the average. In 1860 there were only twenty-three days with a temperature of 70° or above, and in 1879 twenty-six such warm days, so that the past summer is not unique. There has not been, however, a single day this summer with a temperature of 80°, whilst in 1903 the thermometer touched that reading on six days. The aggregate rainfall at Greenwich for the three months was 5·29 inches, which is 1·37 inches less than the average of the past sixty years. In 1903 the aggregate for the corresponding three months was 16·17 inches, which is the wettest summer on record. At the London observing station of the Meteorological Office the aggregate rainfall for the three months was 4·76 inches, which is 2·13 inches below the normal, and the only month with an excess so far this year is April. June was generally wet over nearly the whole country, July was mostly dry, whilst in August the rainfall varied considerably in different parts of the kingdom. At Jersey the total measurement in August was 0·60 inch, whilst the average is 2·48 inches; at Valencia the measurement was 5·67 inches. The sunshine has not varied much from the average. In London there was a slight deficiency in each month, but in the aggregate for the three months it only amounts to thirty-eight hours. September has commenced with exceptionally cold weather, and the thermometer for the first four days has averaged about 30° lower than at the corresponding time last year.

A REUTER telegram from Rome states that it is expected that ratifications will be received by the end of the present year from all the Powers of the convention of June 7, 1905, for the establishment of the proposed International Agricultural Institute. If the expectations are realised the committee of the institute will be able to meet early in 1908, enabling the institute itself to assemble in the autumn of that year, and to be in working order in 1909. In connection with the new institute, the Italian Government is taking steps for the scientific organisation of a system of agricultural statistics which existed until about ten years ago, when it was abolished by Count Guicciardini, Minister of Agriculture, on the ground that it did not afford sufficient guarantees of correctness. By way of experiment, agricultural statistics will be collected this year in fifteen provinces of Italy, with the view of extending the new system to the whole of the country, with any reforms that may be suggested by the experiment. At the same time a count will be taken of the livestock in the country, which has not been done for a considerable time. In this way Italy will in 1909 appear before the International Institute with complete agricultural returns.

THE installation of the first electric irrigation system in southern British Columbia has just taken place. It is considered that by this means the problem of the irrigation of several thousand acres of fruit lands will in a great measure be solved.

AN organisation to be known as the Universal Society of the White Cross of Geneva has been formed at Geneva. It has for its object the coordination of the work being carried on throughout the world in combating tuberculosis, cancer, epidemic and infectious diseases, and social evils such as alcoholism, &c.

ACCORDING to the *Engineer*, an Inter-Ministerial Technical Commission has been appointed by the French Minister of Public Works to organise the whole system of wireless telegraphy in all its branches in the country, and it is expected that the commission will be able to arrive at results which will furnish France with a very complete and properly coordinated service of wireless telegraphy for land and sea service, both in peace and war.

IN 1859 Mr. U. A. Boyden, of Boston, deposited with the Franklin Institute the sum of 1000 dollars, to be awarded as a premium to any resident of North America who should show by experiment that light and other rays travel with the same velocity. According to the August number of the Journal of the Franklin Institute, the premium has just been awarded to Dr. P. R. Heyl, who has taken photographs in the blue and ultra-violet of the variable star Algol in the neighbourhood of its minima, and has shown that the time of minimum intensity of the blue photographs is so nearly identical with that of the ultra-violet that the speeds of the two radiations across the space between Algol and the earth cannot differ so much as one part in a quarter of a million.

THE following arrangements have been made for the opening of the winter session of certain of the London medical schools:—At the Guy's Hospital Physical Society, on October 4, Dr. G. A. Gibson will read a paper entitled "Past and Present"; at King's College, on October 1, Dr. W. H. Allchin will give "Some Observations on the Present State of Medical Education in London"; at the Middlesex Hospital Mr. A. G. R. Foulerton will, on the same date, speak on "The Development of Preventive